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Agriculture and Forestry Sector GHG Reduction Policy Options

CCAG Meeting #2, September 29, 2005

Indicative Potential Emission Reductions* -	**Indicative cost ($/tCO2e)**
High (H): Potentially capable of saving at least 1 Million Metric Tons CO2e per year by 2020 (~1% of current AZ emissions)	**High (H)**: $50/tCO2e or above
Medium (M): Potentially capable of saving from 0.1 to 1 Million Metric Tons per year by 2020	**Medium (M):** $5-50/tCO2e
Low (L): Unlikely to yield more than 0.1 Million Metric Tons CO2e per year by 2020	**Low (L):** $5/tCO2e or lower
Uncertain (U): Too many unknowns to estimate at this time	**Negative (Neg):** Cost Savings

* Several measures may overlap in terms of the emissions reductions. Estimates assume measures would be implemented independently from other measures.

Indication of Priorities:

- **High:** High priority items are deemed deserving of considerable further analysis.
- **Medium:** Medium priority items will be carried forward, with the extent of further consideration and analysis to be determined later.
- **Low**: Low priority items will be moved to a separate list as options to be potentially considered at a later time.

		Priority: High, Med, Low	Implement. Level	Potential Emission Reductions	Cost ($/tCO2 removed	Other Information, Co-benefits, Feasibility Consideration, Examples of Current Activities
	Agriculture – Production of Fuels and Electricity					
1.1	Manure Digesters (methane recovery and electricity production)	High	State, Local Ag. Ext.	Medium	Neg to Low	• Linked with Option 2.2 below
1.2	Biodiesel Production (incentives for feedstocks and production plants)	Medium	State	Medium	Med to High	• Production from both virgin and waste vegetable oils; • Seed oil production in AZ feasible (e.g. soy and rapeseed)?
1.3	Biomass Feedstocks for Electricity or Steam Production	High	State	Low	?	• Need to identify viable feedstocks and volumes [e.g., crop residue (wheat straw, corn stover) or energy crops (switchgrass); • Linkage to Energy Supply TWG to determine availability of biomass plants • Linkage to RCI TWG to identify available capacity for biomass generated steam
1.4	Ethanol Production	High	State	Medium	Med to High	• Current debate on the energy required for ethanol production
1.5	Convert Diesel Farm Equipment to LNG/CNG or Hybrid Technology	Medium	State	Low	Med to High	• LNG/CNG engines or engine conversions reduce BC emissions • Availability of diesel hybrid equipment for farm applications?
1.6	(Additional option, if/as suggested)					•
1.7	(Additional option, if/as suggested)					•
	Agriculture – Fertilizer and Manure Management					
2.1	Nutrient Management (improve efficiency of fertilizer use)	Medium	State, Local Ag. Ext.	Medium	Low	• Note Ag. Best Management Practices under ARS §49-457 (do these extend beyond dust control and water efficiency measures?) • Linked to Option 3.4 below.

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2.2	Manure Management (practices to reduce methane emissions)	High	State, Local Ag. Ext.	Medium	?	• Linked with Option 1.1 above. • Existing waste containment requirements for animal feeding operations > or = 1,000 head. • Could include composting and other measures. • Most of the benefit achieved at dairies. • Co-benefits include reduction of ammonia and VOC emissions.
2.3	Change Feedstocks (optimize nitrogen for N_2O reduction)	High	State, Local Ag. Ext.	Low to Medium	Low	• Most of the benefit achieved at feedlots. • Co-benefits include reduction in ammonia emissions.
2.4	Reduce Non-Farm (Residential and Commercial) Fertilizer Use	High	State	?	?	• Emissions from non-farm application are not currently in the inventory; unclear what the reductions and costs would be.
2.5	(Additional option, if/as suggested)					•
2.6	(Additional option, if/as suggested)					•
	Agriculture – Soil Carbon Management					
3.1	Conservation Tillage/No-Till (carbon sequestration and reduced energy use)	Medium	State, Local Ag. Ext.	Medium	Low	• Boll Weevil eradication program requires cotton residue to be plowed under (conservation tillage not applicable to cotton)
3.2	Reduce Summer Fallow (increase soil C content, reduce N_2O emissions)	Low	State, Local Ag. Ext.	?	?	• Applicability to AZ? • Need estimates of fallow summer acreage
3.3	Increase Winter Cover Crops (increase soil C content, increase soil N content)	High	State, Local Ag. Ext.	?	?	• Applicability to AZ? • Need estimates of winter acreage available for cover crops
3.4	Improve Water and Nutrient Use (to minimize soil C loss)	High	State, Local Ag. Ext.	Low	Low	• Linked to Option 2.1 above; Suggest combining these two.
3.5	Rotational Grazing/Improve Grazing Crops and/or Management	High	State, Local Ag. Ext.	Low	Low	• Applicability to AZ?
3.6	(Additional option, if/as suggested)					•
	Agriculture – Land Use Change					
4.1	Convert Land to Grassland or Forest	High	State	Medium	?	• Opportunities for conversion in AZ?

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4.2	Reduce Permanent Conversion of Farm and Rangelands to Developed Uses	High	State, County, City Planning Offices	High	?	• Reductions occur both from higher retention of carbon in soil and lower transportation activity. • Linked to Option 4.3. • Linked to Smart Growth Options in the TLU TWG.
4.3	(Additional option, if/as suggested)					•
4.4	(Additional option, if/as suggested)					•
	Agriculture – Farming Practices					
5.1	Organic Farming	Med	State, Local Ag. Ext.	Medium	Low	• Reductions occur via lower intensity agricultural practices (nutrient/pesticide application, reduced tillage)
5.2	Programs to Support Local Farming/Buy Local	High	State, Local Ag. Ext.	Medium	?	• Reductions occur through lower transport related emissions.
5.3	(Additional option, if/as suggested)					•
5.4	(Additional option, if/as suggested)					•
	Forestry – Biomass Protection and Management					
6.1	Forest Protection – Reduced Clearing And Conversion to Nonforest Cover	High	State, City/ local	**High**	**Low**	• depends on business as usual rates of land clearing and viable alternatives
6.2	Increase Maintenance of Urban and Residential Trees	High	State, City/ local	**Low**	**Low to high**	•
6.3	Afforestation of Nonforested Rural Lands	Low	State, City/ local, federal	**Low to high**	**Low**	• depends on available acreage and risk
6.4	Afforestation of Nonforested Urban Lands	Low	State, City/ local, federal	**Low to high**	**Low**	• depends on available acreage and risk
6.5	Reforestation/Restoration of Forested Lands	High	State, City/ local, federal	**Low to high**	**Low**	• depends on available acreage and risk
6.6	Reforestation or Increased Densification of Stands	Low	State, City/ local, federal	**Low to high**	**Low**	• depends on available acreage and risk

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6.7	Age Extension of Managed Stands	High	State, City/ local, federal	**Low**	**Low to high**	• involves significant tradeoffs with carbon savings from harvested wood products, as well as ecological risk
6.8	Thinning and Density Management of Managed Stands	High	State, City/ local, federal	**High**	**Low to high**	• cost and technology barriers to market use of harvested biomass may be high; supply potential is high
6.9	~~Fertilization and~~ Waste Recycling	Med	State, City/ local, federal	**Low**	**Low to high**	• site and situation specific
6.10	Expand Short Rotation Woody Crops (for fiber and energy)	Low	State, City/ local, federal	**Low to medium**	**Low to high**	• depends on available acreage and market demand
6.11	Expanded Use of Genetically Preferred Species	Low	State, City/ local, federal	**Low**	**Low**	• primary issues in the southwest are reductions of fuel load and restoration of native species
6.12	Modified Biomass Removal Practices (reduced decay and energy use)	High	State, City/ local, federal	**Low**	**?**	• may be opportunities to use biofuels for equipment
6.13	Fire Management and Risk Reduction Programs	High	State, City/ local, federal	**High**	**Low to high**	• implementation and market barriers may be significant, potential is high if biomass is directed to constructive reuse
6.14	Ecosystem Health Risk Reduction Programs (pest/disease, invasive species)	High	State, City/ local, federal	**High**	**Low to high**	• implementation and market barriers may be significant, potential is high if biomass is directed to constructive reuse
6.15	Drought Management Programs (tree selection, placement, protection)	High	State, City/ local, federal	**High**	**Low to high**	• implementation and market barriers may be significant, potential is high if biomass is directed to constructive reuse
6.16	Flood and Riparian Management Programs (tree selection, placement, protection)	High	State, City/ local, federal	**Low**	**Low to high**	• depends on available acreage
6.17	Watershed Management Programs (stand retention, enhancement and management)	High	State, City/ local, federal	**Low to high**	**Low to high**	• depends on available acreage and forest health issues

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6.18	Habitat Management Programs (stand retention, enhancement and management)	High	State, City/ local, federal	**Low to high**	**Low to high**	• depends on available acreage and forest health issues
6.19	Re-conversion of woodlands to grasslands (e.g. pinon pine and juniper encroachment)	High	State, City/ local, federal	**TBD**	**TBD**	• what are the carbon implications of wood/shrubland conversion from grasslands? • Not all TWG members think this is a high priority
6.20	(Additional option, if/as suggested)		State, City/ local, federal			•
	Forestry - Wood Products and Waste					
7.1	Improved Mill Waste Recovery	High	State, City/ local, federal	**Low to high**	**Low to high**	• technology and market dependent
7.2	Improved Logging Residue Recovery	High	State, City/ local, federal	**High**	**Low to high**	• technology and market dependent
7.3	Expanded Use of Small Diameter Trees for Wood Products and Energy	High	State, City/ local, federal	**High**	**Low to high**	• technology and market dependent
7.4	Expanded Use of Wood Products for Building Materials	High	State, City/ local, federal	**Medium to high**	**Low to high**	• technology and market dependent
7.5	Expanded Use of State and Locally-Grown Wood Products	High	State, City/ local, federal	**Low to high**	**Low to high**	• technology and market dependent
7.6	(Additional option, if/as suggested)					•
7.7	(Additional option, if/as suggested)					•
	Forestry – Energy Production					
8.1	Expanded Use of Forest Biomass Feedstocks for Electricity (fuel switching)	High	State, City/ local, federal	**High**	**Low**	• technology and market dependent

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8.2	Improve Use and Efficiency of Wood for Direct Commercial Heat and Energy	High	State, City/ local, federal	**High**	**Low**	• technology and market dependent
8.3	Improved Energy Capture from Wood Waste Combustion	High	State, local, private	**Low to high**	**?**	• technology and market dependent
8.4	Expanded Landfill Methane Recapture (wood products waste)	High	State, City/ local	**Low**	**Neg to Low**	• Federal New Source Performance Standards and Emissions Guidelines require methane capture at larger landfills.
8.5	Improved Commercialization of Biomass Gasification and Combined Cycle	High	State, City/ local, federal	**Low to high**	**Medium to high**	• requires improved technology and market incentives
8.6	Expand Usage and or Efficiency of Wood Waste as Residential Fuel Source	High	State, City/ local, federal	**Low - Medium**	**Low**	• Overlap with RCI sector.
8.7	(Additional option, if/as suggested)					•